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Original Article

Impact of COVID-19 on mental and emotional health of dental undergraduate students: a cross-sectional study.

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Abstract:

Introduction: COVID-19 pandemic has disrupted all walks of life. The psychological impact of COVID-19 has been shown to be immense in terms of moderate to severe depressive and anxious symptoms in general public. Such data is important on dental undergraduates to help them cope with stress and promote overall wellbeing. **Aim:** To assess dental undergraduate students' perception on impact of COVID-19 on their physical, mental and emotional health. **Materials and Methods:** A cross-sectional survey was undertaken among 227 students of Faculty of Dentistry, SEGi University, Malaysia. A questionnaire containing 25 close ended questions was developed and validated at the faculty. The survey was electronically disseminated through google forms. Data was analysed using SPSS version 22. Descriptive statistics and chi-square test were used. $p < 0.05$ was considered as statistically significant. **Results:** The response rate was 85.4%. About 80% of students were concerned that their

physical health might be impaired. About 40% reported disturbed sleep, 60% were anxious that they might contract coronavirus while treating patients or attending face to face class. More than half of them felt financial instability and 70% students' emotional health was affected. About 30% felt angry, lost control and stressed due to pandemic changes. About 43% missed their social life and 20% felt lonely and depressed during the pandemic lockdown.

Conclusion: Covid-19 has had an impact on mental and emotional health of our dental undergraduates. The faculty has already initiated suitable measures to provide them with necessary moral and psychological support.

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Introduction:

Coronavirus disease (COVID-19) is an infectious disease caused by the newly discovered coronavirus. The World Health Organization labelled the Novel Coronavirus Disease 2019 (COVID-19) a pandemic in March 2020 as it spread quickly over the world, impacting all facets of daily life. As a response to this pandemic, the Malaysian government imposed social and physical distancing, as well as self-quarantining, due to the virus's primary mode of transmission, being direct contact, i.e., droplets transferred by infected individuals coughing or sneezing. Quarantine on one hand helped to curtail the spread of virus, but on the other hand, had significant impact on economic, social, and psychological health. As a result, several obstacles and issues, including psychological pressures, have arisen as a result of this and affected individuals.¹ Recent research on COVID-19 reveals that healthcare workers (HCWs) experience high levels of stressful and traumatic events, and that their mental health is negatively affected including stress-related symptoms, depression, anxiety and insomnia.²

Several other safety measures were also taken by the government ranging from the temporary postponement of educational activities and events to the complete shutdown of schools and colleges. Online and distance learning became the most widely used method of education, bringing with it a slew of new issues and concerns, one of which was effects on mental health of students.³ The psychological impact of COVID-19 has been shown to be immense in terms of moderate to severe depressive and anxious symptoms.⁴ Individual mental health is an important public health concern that is likely to be disrupted during pandemics, such as the COVID-19 pandemic. Previous research papers have found that a considerable rise in the incidence of mental health disorders after similar virus outbreaks. Anxiety, depression, and traumatic stress are among the common problems faced. Individuals in various parts of the world have also reported higher levels of tension, anger, anxiety, and depression as a result of the recent COVID-19 outbreak.⁵

Due to the extreme pandemic's unprecedented character, which affected students at all levels of training, collection of data was required to determine the psychological effects of the COVID-19 pandemic among undergraduate dental students, so that suitable remedial measures could be undertaken. Hence, this study was undertaken. The aim was to assess the Impact of COVID-19 on mental and emotional health of dental undergraduate students with the objectives of using a questionnaire to identify students requiring additional help.

Methodology

This was a descriptive cross-sectional study carried out at Faculty of Dentistry, SEGI University, Kota Damansara. The study was approved by the SEGI Ethics committee (SEGiEC/SR/FOD/2020-2021). Permission to carry out the study on all dental undergraduate students of the faculty was obtained from the Dean. Informed consent was obtained from all the

participants. This study was carried out for 1 month starting from October 2020 until November 2020.

The study participants were clinical year dental students from Faculty of Dentistry at SEGI university Kota Damansara who are students from Year 1,2,3,4 and 5 totalling to 227 students. We included all clinical year dental students from Year 1 to Year 5 without any bar for age and gender. We excluded those students who did not consent to participate in the study.

A validated questionnaire was used as our study tool. The Questionnaire was adopted from a previous study.⁶ It was modified based on our needs and validated for clarity on 10 students. The questionnaire included 25 close ended questions pertaining to demographic details, mental and physical health of students, questions related to their financial status and emotional health . Minor modifications were made to the questionnaire based on the feedback from the students. Internal consistency was checked using Cronbach's alpha which showed a value of 0.79. The questionnaire was transferred to Google forms and electronically disseminated through email and whatsapp.

Data Analysis:

The excel sheet was downloaded and transferred to statistical software. Data was analysed using SPSS version 22. Descriptive statistics and chi-square test were used. $p < 0.05$ was considered as statistically significant. Data was presented as tables.

Results

Out of 227 students, 193 responded to the survey leading to a response rate of 85%. About 66% (126) were females and 34% (67) were males. The mean age of the participants was 21.8 ± 0.5 years. Out of 193 (100%), 17% were from year 1, 21% from year 2, 19% from year 3, 22% from year 4 and 21% from year 5.

The results were split into 4 sections, mental health, physical health, financial health and emotional health.

Mental health

About 80% of the respondents said that they were more concerned about their mental health now than before. About 40% could not have normal sleep and about 60% said that they are anxious about contacting COVID-19 infection. Table 1. Shows the responses for fear about mental health.

Table.1: Responses for questions pertaining to fear about mental health

Fear about mental health	Yes %(N)	No %(N)	Maybe %(N)
More concerned about physical health now than before	79.8% (154)	6.7% (13)	13.5% (26)
No normal sleep during COVID-19 pandemic	38.3% (74)	49.7% (96)	11.9% (23)
Anxious about contacting COVID-19	60.1% (116)	10.4% (20)	29.5% (57)

Physical health

About 64% were worried about contacting COVID-19 while treating patients, 51% were worried about contacting COVID-19 while attending class and about 64% were worried about contacting COVID-19 while in the campus. Table 2. Shows responses for questions pertaining to physical health.

Table 2: Responses for questions pertaining to physical health.

Worried about contacting COVID-19	Yes % (N)	No % (N)	Maybe % (N)
While treating patient	63.7% (123)	11.4% (22)	24.9% (48)
While attending class	50.8% (98)	15% (29)	34.2% (66)
While in the campus	63.2% (122)	5.2% (10)	31.6% (61)

Financial Health

About 60% felt financial instability, 45% felt that it would be difficult to get a job in the future. Only 29% said that they could meet their financial problems during the pandemic. Table 3 shows the responses related to financial insecurity.

Table 3: Responses related to financial insecurity.

Fear related financial insecurity	Yes % (N)	No % (N)	Maybe % (N)
Financial instability	59.1% (114)	21.2% (41)	19.7% (38)
Getting a job	44.6% (86)	17.6% (34)	37.8% (73)
Difficulty in meeting needs	29% (56)	34.7% (67)	36.3% (70)

Emotional health

About 72% were able to control their emotional health, 30% felt that they did not have control over important things in life during the pandemic. About 35% could not cope up with their routine, 42% Felt stressed, 29% Felt angry, 54% Felt uncertain about their

future,21% felt depressed,92% were worried about their family members 43% said they missed social activities and about 20% felt lonely. Table 4 shows the responses pertaining to emotional health.

Table 4: Responses related to Emotional Health.

Fear about emotional health	Yes %(N)	No %(N)	Maybe %(N)
Ability to control emotional	71.5% (138)	8.3% (16)	20.2% (39)
No control over important things	29.5% (57)	40.9% (79)	29.5% (57)
Coping up with routine	35.2% (68)	35.2% (68)	29.5% (57)
Feeling stressed	42% (81)	23.8% (46)	34.2% (66)
Anger	28.5% (55)	37.3% (72)	34.2% (66)
Uncertain about future	53.9% (104)	20.2% (39)	25.9% (50)
Depression	21.2% (41)	50.8% (98)	28% (54)
Worry about family member	92.2% (178)	3.6% (7)	4.1% (8)
Missing social activities	43% (83)	35.8% (69)	21.2% (41)
Loneliness	19.7% (38)	56.5% (109)	23.8% (46)

Discussion

On 30th January 2020, WHO declared the 2019 novel Coronavirus outbreak as a Public Health Emergency of International concern. The Malaysian government imposed the Movement Control Order (MCO) on the 18th March 2020 to control the spread of virus in our country. Studies during the previous pandemic have shown that fear of infection, frustration due to lockdown and stigmatization can harm the mental health of the people.⁵

Mental health covers emotional, psychological and social well-being. It determines how we perceive, act and respond to external and internal stimuli in order to help us to decide how we cope with tension, interact with others, and make decisions.⁷ Stress during an infectious disease outbreak can have some impacts on physical, mental and emotional health such as fear and worry about their own health and the health of their loved ones, changes in sleep or eating patterns, difficulty sleeping or concentrating, worsening of chronic health problems, worsening of mental health conditions and increased use of tobacco, and/or alcohol and other substances.⁸

Symptoms of adverse psychological outcomes were seen when individuals were challenged by mandatory quarantine, unexpected unemployment, and uncertainty associated with the COVID-19 outbreak. A high level of psychological stress has been found during COVID-19 pandemic among general population. which has highly included students, health care professionals workers and patients too. ^{9,10}

This study has investigated the impact of COVID-19 on mental and emotional health of dental undergraduate students as students are known to be the most vulnerable age group of 18-25 years for developing negative psychological well-being due to disruption of social and academic activities. Moreover, some of them were away from their families which might make them more insecure and feeling lonely. Hence, this study was undertaken to identify such students and help them.

The results of our study showed that half of our study participants feared contacting COVID-19 when they resumed classes which reveals the double-edged nature of COVID-19 lockdown. On one hand, there is fear of contacting virus if they go out while on the other hand there is depression and loneliness being at home. Several studies done across the world on dental and medical students have shown a high stress level during the pandemic. A study done in Turkey found that medical students were highly worried about being infected with COVID-19.²

The main indicators of psychological health includes depression, anxiety and stress. In our study, prevalence of depression was 20%, anxiety was 35% and stress was 42%. A study conducted among University students in US showed a 71% prevalence of stress,¹⁰ and Jordan students also showed higher stress levels during the pandemic.¹¹ The global prevalence of depression, anxiety and stress has been reported as 33.77%, 31.9% and 29.6% respectively, in the adult population by a systematic review.¹²

By reviewing the result of our survey, we can understand that our participants having depression could have been because of loneliness and lack of normal social gatherings and meeting friends on campus. In a study on university students in Italy, more than 70% agreed that lack of social interaction was main reason for depression.⁹ COVID-19 has had significant impacts on daily life, ranging from Stay-at-Home orders at the time of the survey to social distancing and mask wearing practices as areas have lifted restrictions. These overarching public health measures may have contributed to feelings of distress. Anxiety could have been also due to uncertainty about graduating on time, fear of increasing backlog of clinical work and the non-availability of the cases to complete the competency test.³ Our participants had a higher level of stress compared to global values. This can be attributed to change in their routine from classroom to online activities with more asynchronous learning off the campus.

Also, in our study, more than half of the students experienced financial instability, fear of lack of future job opportunities and one third faced difficulties in meeting their regular financial needs. During the pandemic, families have experienced financial troubles due to salary cuts, retrenchment, dying business activities and lack of employment opportunities. Student income is often dependent on maintenance loans, and many report resulting financial hardship- which is also an identified risk to mental health in pandemics.⁶ More than 90% of the students feared about a family member contacting COVID-19. The fear is but natural when one stays away from the family and fear of losing near and dear ones to a pandemic especially when the infection rate was on an increasing trend. A study conducted on dental students in Riyadh also showed similar results that students worried that they themselves or a family member might get infected with COVID-19.¹³ On the good side of view, our participants had a lower level of depression as compared to the global values, this could be attributed to the online mentoring sessions organized by faculty every week to heed to students' academic and personal issues.

Conclusion: Covid-19 has had an impact on mental and emotional health of our dental undergraduates. The faculty has already initiated several suitable measures to provide them with necessary moral and psychological support, like online mentoring, buddy programme, support through student societies etc.

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Short communication

Challenges and strategies adopted in dental education during COVID-19 pandemic: An institutionalized experience

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Abstract

The unprecedented outbreak of COVID-19 in 2020 has significantly affected the curriculum delivery and clinical dental practice in dental schools. Many dental schools across the globe were temporarily closed to prevent the spread of the virus. On 18th March 2020, Malaysia for the first time declared a total lockdown resulting in switching to an online learning platform with live lectures, live interactive sessions, online group discussions, pre-recorded theoretical lectures, case presentations, and electronic learning tutorials. In addition, all elective dental treatment was deferred, and only emergency dental procedures were carried out with strict standard operating procedures (SOPs). The dental curriculum across the dental schools are similar with regard to their contents, however, each dental school has had its own modification of the educational process with regard to Teaching and learning methodology. The common strategy adopted by all dental school was the cease of practical and clinical sessions, and the introduction of online teaching-learning activities. At Faculty of Dentistry SEGi University, we addressed some of the challenges that encompass various dimensions of teaching-learning and safety of students, and concurrently bringing in an innovative student-centric approach to education and their well-being. This paper aims to provide insight into the various challenges encountered during this pandemic, strategies adopted

to overcome them at our institution, and a brief insight into future opportunities in teaching and learning in dental education.

Keywords: Dental Education, Dentistry, Online learning, Curriculum

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Introduction

The emergence of the new Corona Virus called SARS-Cov-2 in December 2019 and the World Health Organization's (WHO) announcement on 11th March 2020, COVID 19 as a pandemic has prominently affected dental education and delivery of patient care. The gravity of the pandemic has led to the implementation of lockdown measures and restricted academic face-to-face activities to curb the spread of infection by the Malaysian government.^{1,2} This unprecedented disruption challenged the long-held beliefs in the dental education system, teaching and learning methods in dental schools and forced them to implement the new norms.^{3, 4} Many dental schools around the globe have adopted online teaching and deferred preclinical and clinical training to avoid face to face contact among the dental staff, students and patients. Additionally, dental students, unlike other medical students, are highly vulnerable to contracting the virus owing to the nature of their clinical training akin to aerosol-generating procedures and, proximity to the patient's oral cavity, which in turn has led to fear and anxiety among the dental students in addition to the various other academic and non-academic challenges.⁵

Although our school has successfully switched to online teaching, it was challenging to reinstate the preclinical and clinical training while ensuring safety among dental students, staff and patients. This affected their ability to apply gained knowledge and develop critical thinking in a clinical setting. Undoubtedly, switching to online learning and the lack of adequate clinical training during

this pandemic has affected their competencies, thus resulted in under confidence in performing dental procedures. Therefore, it was imperative to adopt a strategies that allowed online teaching and provided adequate clinical training by adopting the strict SOPs and guidelines for the dental practice.⁵ Many dental schools have adopted unique ways of tackling these issues by implementing various innovative teaching and learning methods. The following section highlights some of the key challenges and strategies adopted by our faculty to overcome this pandemic.

Challenges and strategies used (Table 1)

1. Mental health and well-being of dental students

With the spread of COVID-19, the effect of lockdown on psychological well-being has been profound. Many dental students at our faculty expressed stress and anxiety, affecting their studies during the pandemic. The most common concern was isolation, the lockdown's unpredictability, and its implications on their immediate future.

To overcome the anxiety, we attempted to incorporate app-based meditation into the students' learning time (for some of them) for one month to improve their resilience and reduce stress. As a result, there was a positive impact on students with regards to resilience, awareness of thought patterns, emotions, and reactivity levels. The current generation is technology-friendly, and the same platform could be used to perform remote psychological support. This small approach made a huge difference to the cohort in terms of well-being and positive psychology approaches.⁶

Furthermore, we implemented the Online Mentor-Mentee Program (OMMP) to provide academic, moral, and psychological support to students. OMMP involves trained, committed, and empathetic faculty members as mentors who guide and support students in academic and personal matters using online virtual platforms. This program provided moral and psychological

support to students and enabled them to communicate, socialize, and enhance their professional networking skills and confidence.⁷

Similarly, dental faculty members have been under significant pressure as they are expected to adapt to unfamiliar new methods of teaching quickly, assessment, comply with dynamic policies set by the university and professional bodies, and at the same time, keep students engaged and motivated during the pandemic. Additionally, online teaching and work from home culture resulted in difficulty in prioritizing their personal and professional schedules. Therefore, it was incumbent to provide essential training for dental faculty members to adapt to the new normal teaching strategies and reprioritize their professional goals and assigned responsibilities.⁸

2. Alternative teaching methods

After the implementation of the lockdown measures, online instruction replaced all the didactic classroom-based components of the curriculum using synchronous and asynchronous approaches. The faculty members utilized a variety of technological platforms to facilitate the delivery of virtual lectures, conduction of group discussions, seminars, PBL, and case studies. Many alternative teaching methodologies have been conducted to enhance student engagement. One such teaching methodology we adopted was using the Microsoft Whiteboard tool to ideate, create, and collaborate visually. This tool was used to teach periodontal surgery principles kinesthetically, including flap designs and incision principles. This mode of teaching demonstrated positive feedback in understanding these topics through remote access.⁹ Moreover, emphasis was given to Online Peer Assisted Learning and Guided self-directed learning for effective utilization of available time.⁵

3. Patient care and teledentistry consultations

Due to the high-risk COVID-19 transmission in the dental clinics, elective dental treatment was suspended, and students and faculty members rendered only emergency treatment by following

stringent SOPs. To address the patients' concerns, we have adopted the teledentistry consultations by students and faculty members to provide online patient consultations. Such consultations served as compensatory training for students for their canceled clinical sessions, external clinical training, and inadequate clinical exposure. Currently, Teledentistry is being used for online consultation, diagnosis, triaging, and monitoring of patients. Although this technique lacks the essential psychomotor assessment for students, it has proven to be very beneficial for ensuring continuity of patient care, prioritizing patients' needs, and potentially alleviating anxiety caused by significant delays in scheduling their appointments. Besides this, it also reduces the use of PPE and other precious clinical resources during the pandemic.¹⁰ Additionally, patients were informed regarding the flexibility in operating our clinics through social media platforms and faculty websites and they were reassured regarding the measures taken to ensure their safety during dental appointments by year five students and faculty members.

We have redesigned the patient reception and waiting areas to reduce the close contact and ensure prompt physical distancing. Besides this, proper triage and pre-entry checkpoint for all patients, faculty, and students before entering the clinic was prepared. The use of hydrogen peroxide mouthwashes, rubber dams, and high-volume suction also was reinforced, as they minimized aerosol production.¹¹

4. Achieving the Minimum Clinical Experience (MCE) and Expected Clinical Experience (ECE)

Adequate clinical training and hands-on experience with the patient are critical components in providing competent dental care with high confidence. In all the dental faculties in Malaysia, it is being guided by the achievements of MCE and ECE. MCE consists of quantitative (minimum number of requirement) and/or qualitative measurements according to rubrics of clinical

assessment, whilst ECE comprises of expected clinical and procedural experiences prior to the final professional examination / graduation. Therefore, to give adequate clinical training, particularly for year five students, our dental program was resilient enough to extend the end dates corroborated by the Dental Deans' Council, and additional clinical sessions were provided to complete their quota after the theoretical examination. Additionally, the Dean's caucus has revised and standardized the MCE and ECE requirement for dental students for graduation requirements with strict regulations and guidelines.

5. Assessments

Many dental schools have creatively used a variety of online tools during the pandemic not only for teaching but also for assessment. The assessment structure was redesigned and the question paper pattern was modified for ease of conducting the online examinations. We have conducted semester examinations and professional examinations using Blackboard, an online learning platform for teaching and learning. This platform provides a viable option for conducting various assessments. It is possible to incorporate different types of questions such as multiple-choice questions, Modified essays questions, short answer questions, virtual oral examinations, and video production for assessment.¹²

Numerous online platforms such as Kahoot, Socrative, etc. are also available to conduct regular assessments during the online classes. Despite the successful experience with online teaching - learning and online theoretical examination, it remains challenging to conduct clinical examinations. Assessment of the clinical competency, psychomotor skills, and patient management skills are the vital component of students' learning that cannot be compromised. Thus, we conducted the Objective Structure Practical Examination (OSPE) and Objective Structure Clinical Examination (OSCE) with stringent SOPs and physical distancing measures for all the students.

6. Research

Due to the repeated lockdowns, both basic laboratory-based and clinical-oriented research projects have been negatively affected, leading to a significant hindrance to the research productivity of faculty members. This has led to the delay in the completion of ongoing student and staff research projects and the termination of a few research projects. On the contrary, the scope for online research projects and manuscript writing and publication activities has been positively impacted during the lockdown as faculty and students utilize the time usually spent in the clinic and for patient care.¹³

Research related to COVID-19 has also been on the rise, and it may be an opportunity for researchers to pursue research in this domain even during the pandemic. To effectively utilize the available time and inculcate a positive attitude toward research, and innovation, our year 4 students were given an online research project which faculty members supervised to enhance their research skills during the lockdown.¹⁴

Furthermore, community-based MPU projects were carried out using online platforms and various social media sites such as Facebook and Instagram, which benefited students, patients, and the community. These webinars intended to make dental knowledge accessible to all ages through the comfort of one's home. The groups that took part, used the official SEGi Students Dental Society page along with the aid of the SEGi Students Council to have live real-time discussions with the objective of educating all viewers on the importance of oral care, and the feedback was quite encouraging.

7. Faculty Development Program and Collaboration

During this pandemic, several physical conferences, continuing education activities, and scientific meetings have been canceled. Alternatively, online conferences, summits, seminars, workshops, have been successfully conducted using online platforms at national and international levels. Their popularity

and wide acceptance are attributed to their ability to overcome the place constraints of traditional settings, allowing professionals across the world to share ideas by utilizing technology that is readily available and accessible.¹⁵ At SEGI university, we have successfully organized an online National Dental Students' Scientific Conference (NDSSC) 2021 to encourage dental students to interact, compete, and build fellowships with peers from other dental schools in Malaysia. Additionally, it also provided the platform for presenting their research projects online.

Future prospective in dental education

Although the pandemic has led to a plethora of challenges, it also brought many positive outcomes in dental education. Pandemic crises forced the majority of dental schools to challenge their conventional teaching and learning in dental education and swiftly adapt to online to ensure the continuity of teaching and learning. This was facilitated by the currently available online innovative technologies, which are expected to persist even after the pandemic. The most significant favorable outcomes that have emerged are the unprecedented level of connection and communication within the dental education community. This was reflected in enhanced educational cooperation, research collaborations, and freedom to create and share learning content.

Besides this, dental schools have gained invaluable learning experience in managing the unprecedented crisis and prepared dental educators for future unforeseen challenges in future. This also could bring an array of opportunities for students and dental faculty members to pursue online dental courses from different parts of the world.¹⁶

Albeit currently available technologies may suffice the theoretical teaching, they are still not equipped to completely replace the conventional hands-on clinical training offered in dental schools; nonetheless, few clinical domains can be tested online and there

is scope for adopting the several alternative domains that may be a part of future of dental education. Present innovative technologies such as haptic, virtual reality, and augmented reality needs further enhancement and must be affordable and portable. These platforms mimic patients and aid in the virtual continuity of clinical education and assessment during crises time.¹⁷ Dental schools must use this opportunity to embrace various applications and software focused on complex clinically based scenarios that can be used in virtual group discussions to improve student's decision-making and diagnostic skills. Concurrently, dental faculty members must focus on designing the various online modules, courses, and assessments for dental students.¹⁸

Pandemic crises have reflected the potential gaps in our existing curricula and scope for improvement. Dental schools must adopt stringent infection control protocols, and this topic must be comprehensively introduced into the dental curriculum. Teaching and practicing Teledentistry was also proposed as a potential solution to increase the acceptability with patients. Teledentistry may persist after the current pandemic passes, particularly in oral medicine and surgery discipline therefore it is justified to inculcate this into dental curricula.¹⁹

Conclusion

The COVID-19 pandemic challenged the traditional curricular delivery methods and enabled dental schools to rethink alternative curricular delivery models and concurrently provided many opportunities. The majority of the challenges posed by COVID-19 were tackled creatively by dental educators by using new technological platforms. However, at present clinical training cannot be replaced with the existing technology.

Table 1: Summary of key challenges and strategies adopted by our faculty during the COVID-19 pandemic

Area	Challenges	Solutions
Teaching and learning		
Method of curriculum delivery	Unable to conduct face-to-face teaching of Didactic components such as theory classes, CBL, PBL, Seminars, Group discussions.	Switched to online using Microsoft Teams, Zoom, WebEx, Google meet, Blackboard
Preclinical practical's	Dental anatomy and tooth carving session	Live demonstrations of Online tooth carving sessions through online platforms and hands-on training sessions for students
	Preclinical prosthetic teeth setting	
	Sim lab exercises: cavity preparation, and crown cutting	Faculty members prepared the Pre-recorded videos of cavity preparation, and crown cutting and uploaded them in Blackboard.
Clinical sessions		Postponement of the clinical session to year 3 and 4. For Year 5 students, clinical sessions were conducted with stringent SOPs. Teledentistry consultations by students and faculty members to provide online patient consultation.
Demonstration of clinical and preclinical procedures	Unable to give a face-to-face demonstrations	Live demonstration sessions or prerecorded videos of clinical procedures such as scaling, crown cutting, impression procedures, orthodontic wire bending, preventive procedures, Lymph node examination, TMJ examination, intraoral and

		extraoral radiographic techniques...etc were uploaded to Blackboard by faculty members.
External clinical posting	MOH clinical posting	Conducted online for year 5 students
Assessment		
Mode of conduction		Conducted online using Blackboard
Short/ Formative assessment		Online Socrative, Kahoot ...etc
Graduation ceremonies		Conducted online
Examination Meetings		Conducted online
Patient Care		
Elective care		Rescheduled and Teledentistry was conducted
Emergency care		Provided with strict SOPs or through teledentistry
Research		
Basic and clinical research		Conducted online
COVID-19 research		Increase in research activities related to Oral manifestations of COVID-19 and COVID-19 vaccine side effects.
Writing and publication		Increased, particularly in the field of systematic reviews, <u>Cochrane Reviews</u> , and metanalysis.

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Short communication

Taste Perception and COVID-19

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Introduction

COVID-19, the coronavirus disease 2019, an infection of the Severe Acute Respiratory Syndrome CoronaVirus 2 (SARS-CoV-2), needs no introduction. As of 1st March 2022, over 5.9 million individuals have lost their lives to the disease, globally¹. Although the world population is hurtling to get vaccinated against this dreadful disease, the scientific community is still grappling with the conundrum of finding cures for the persistent, long-term symptoms (over four weeks after infection) in recovered individuals, commonly referred to as the long COVID-19². Factors such as cellular damage due to either the disease or treatment or both, persistent viral shedding, body's response to the immune inflammatory process, and the enhanced tendency for blood clotting induced by the infection, have all been hypothesized as contributing factors to the symptom sequelae³.

Among the myriad clinical symptoms of COVID-19, an abrupt impairment or loss of the sense of taste (hypogeusia/ageusia/dysgeusia) has been reported frequently⁴. Over a short span of time and numerous case reports later, this symptom has been identified as a significant one, because of its presence, at times, as the only clinical symptom when all other typical symptoms such as such as fever, cough, respiratory failure, are absent during an episode of COVID-19 infection. In many cases, it is accompanied by the impairment or loss of the

sense of smell (hyposmia/anosmia). These symptoms are recognized as common symptoms in patients even in their asymptomatic phases. Furthermore, loss of taste or ageusia has been commonly reported as a persistent symptom of long COVID-19, and in many cases with little improvement after two months which could be worrisome especially in patients with comorbidities^{5,6}. Following is a brief note on the physiology of the gustatory mechanism and the etiopathogenesis of its impairment in long COVID-19.

The Gustatory Mechanism

The sensation of taste occurs when three specialized nerve fibres are activated, namely taste, orosensory, and gastrointestinal fibers⁷. As we are well aware of, the taste buds, are widely distributed in the papillae of the tongue, palate, larynx, and oesophagus, and form the chemosensory units. Each taste bud is made up of about 50 to 100 specialized epithelial cells. These cells are called the taste receptor cells and are of three types, viz. type-I also known as the glial-like cells, type-II cells which express G-protein coupled receptors (GPCR) for sweet, bitter, or umami tastes, and type-III which are presynaptic cells. Intercellular transfer of information takes place between the gap junctions of these cells that are chemically and electrically charged. The taste buds open on their apical end through a pore filled with microvilli and are innervated by the cranial nerves V, VII, IX and X which transmit information about the chemical nature and quantity of the substances tasted (tastants). Also, these cells are encircled by general sensory thermoreceptors and mechanoreceptors that convey the thermal and physical properties of foods. On the whole, the peripheral gustatory system transmits the sensory information of the tasted foods through neural pathways to the brain resulting in specific taste perception⁷.

The Perception of Taste

The tongue is usually covered by a mucosal film commonly referred to as the “tongue film”. Food substances that we eat diffuse through this mucosal film to the apical opening of the taste buds, and the stimulation of the taste receptor cells takes place⁸. Studies have shown that this ‘tongue film’ harbours unique ecological niche for microbial colonization. The by-products of these microbial metabolism can modulate the threshold for specific taste sensation⁹. The tongue film in healthy individuals is found to be rich in bacterial species of the Firmicutes phylum that metabolizes lactate producing acetate and propionate by-products¹⁰. When a high proportion of acetate is present in the vicinity of the taste receptor cells, an increased threshold for sweet perception is noted. On a similar note, a high concentration of organic acids in the tongue film, reduces the sensitivity for fat perception⁸. The turnover rate of taste bud cells is about 8-12 days, as they undergo continuous renewal. Homeostasis of these cells is dependent on the regular supply of properly differentiated taste receptor cells. If the turnover is rapid then an increase in the rate of cell extrusion and apoptosis is seen, to avoid overcrowding and maintain the homeostatic status¹¹. Thus, the epithelial cells in healthy tongue films are in different stages of differentiation, such as the basal, parabasal, intermediate, and superficial keratinized cells. The rate of multiplication of epithelial cells, quantity of desmosomes and membrane-coating granules are factors that affect the formation of the tongue film⁹. Solubilizing, diluting, and chemical modification of the food substance can depend on the microbial composition and the saliva in tongue films¹⁰.

Etiopathogenesis of the Gustatory impairment in COVID-19

The infectivity of an invading virus is dependent on the local commensal microbiota. In most instances, the invading viral organisms increase the prevalence or survival of the pathogenic/opportunistic organisms, thus disrupting the normal

host-microbiota homeostasis and causing dysbiosis and upregulates the inflammatory response. This in turn determines the immune modulation and response, and the extent of the viral infection in the host¹². Virally attacked epithelial cells display biochemical changes due to the degradation of host proteins and synthesis of viral proteins. For instance, in influenza virus infection, there is a reduced secretion of growth factors which retard stem cell activity, upregulate inflammation and apoptosis of taste bud cell apoptosis. These events have been hypothesized as mechanisms for the chronic taste and smell loss in influenza virus infection¹³. In SARS-CoV-1 infection, patients have been shown to present pale red tongue suggestive of exfoliation of less differentiated cells¹⁴.

It is now known that the taste bud cells, and other oral epithelial cells express angiotensin-receptor-2 (ACE2), the entry receptor for viruses of the Coronaviridae family including the SARS-COV-2. Besides this, we know that the taste bud cells also express TLRs, especially TLR 2,3 and 4 are highly expressed in the gustducin-expressing type II taste bud cells¹⁵. CoV-2 replication and infection has been to occur within the taste bud cells. This causes a breakdown of the gustatory mechanism by direct invasion and inflammation of the taste bud cells¹⁶. CoV-2 is capable of using multiple entry receptors such as the salivary sialic acid receptors and the toll like receptors (TLR) to enter the host. Sialic acid is a component of saliva that protects the glycoproteins responsible for the transport of molecules stimulating taste in the taste pores. When SARS-COV-2 binds to salivary sialic acid receptor, the transport of the food substance through the glycoprotein is affected. This eventually leads to an impaired taste perception¹⁵. Similarly, the binding of the CoV-2 to TLRs could impair taste sensation¹⁶. It has been established that with a high serum level of the pro-inflammatory cytokine interleukin 6 (IL-6), there has been disturbances in gustatory response. IL-6 has been found to be persistently high in the serum of COVID-19 patients¹⁷. Furthermore, persistent inflammation

increases the incidence of epithelial cell exfoliation. These exfoliated cells harbour the viral particles and could be a reservoir for viral RNA in saliva of patients with persistent long COVID-19, thus impairing gustation for longer duration¹⁸. The predominance of *Prevotella salivae* and *Veillonella infantium* in COVID-19 patients' oropharyngeal swabs has been found to correlate with an increase in inflammatory cytokines¹⁹.

Summary

Prolonged impairment of the gustatory mechanism and the shedding of viral RNA particles are suggestive that reservoirs for SARS-CoV2 within the taste receptor cells and epithelial cells exist, acting as a source for active or latent taste dysfunction in long COVID-19. Due to the presence of the viral particles in saliva, there is an imbalance in the normal ecological balance of the oral environment, causing dysbiosis and altered epithelial homeostasis. This further causes an upregulation of the surge of pathogenic microbes and prolonged inflammation, resulting in the persistent release of pro-inflammatory cytokines. With persistent inflammation, an increase in the exfoliation of epithelial cells is seen, thus increasing the viral load in saliva. The failure to replenish the lost epithelial cells swiftly due to altered cell turnover could result in fewer taste receptor cells concomitantly leading to persistent taste disturbance.

Conclusion

Impairment in the gustatory mechanism seems to be a significant and sometimes early symptom in COVID-19, and could present as ageusia, hypogeusia or dysgeusia. Due to this symptom, patients could experience lack of appetite and interest in eating which may result in reduced food intake that can translate to lower energy levels and malnutrition. This could be very crucial for patients with co-morbidities. For this reason, basic knowledge of the gustatory mechanism and awareness of this important symptom is pivotal for dentists and dental students,

to help in the early detection and diagnosis of COVID-19 cases in future.

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Case report

Sore throat or sore tooth? A case of chronic pharyngitis and recurrent mouth ulcers

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Abstract

Sore throat and mouth ulcers are two common conditions seen at the outpatient clinic of family physicians or otolaryngologists. In this case, a 37-year-old female patient had a sore throat and recurrent mouth ulcers that persisted for two months. Despite two courses of oral antibiotics and various investigations, her problem did not resolve. It was later discovered that the patient had a re-root canal treatment and a metal crown fitted prior to the onset of her symptoms. The patient had an uneventful recovery following the removal of the metal crown. Had the dental history been carefully explored, the patient would not have suffered a prolonged course of the condition. This case also demonstrates the importance of careful use of antibiotics in the medical practice, and metal materials in the dental practice.

Keywords: chronic pharyngitis; mouth ulcers; allergy; metal crown

Introduction

Sore throat or pharyngitis is a very common condition seen by family physicians and otolaryngologists whereas infection remains one of the most common causes of the condition. Most of the time, the causative agent is viral rather than bacterial.¹ While it usually resolves on its own within one to two weeks, pharyngitis may persist for a longer-than-usual period in some cases such as in infectious mononucleosis, which is caused by the

Epstein-Barr Virus (EBV) presenting with pharyngitis, cervical lymphadenopathy, fatigue and fever.² Other causes of sore throat include allergies, dryness, irritants (e.g. tobacco smoke or chemicals), muscle strain (e.g. in yelling, talking for long periods), gastrointestinal reflux disease, tumour, abscess and epiglottitis.³

On the other hand, mouth ulcers are another commonly seen condition in the outpatient clinic. In most cases, mouth ulcers do not have a serious underlying cause and they normally heal within a week or two. In some cases, however, oral ulcers may be multiple and recurrent which warrant further attention. Some serious conditions that are associated with recurrent oral ulcers include Bechet's syndrome, Sweet syndrome, infection with human immunodeficiency virus (HIV) and cyclic neutropenia.⁴

Case presentation

A 37-year-old female patient was seen in the primary care outpatient clinic with the chief complaints of fever, sore throat and a painful right-sided neck lump for one week. Prior to the onset of the symptoms, the patient had a re-root canal treatment done on tooth 32 (lower last molar) which was later covered by a metal crown. She was diagnosed with bacterial pharyngitis and was prescribed a course of combination antibiotics consisting of amoxicillin and clavulanic acid. Due to the persistent symptoms, she was referred to an otolaryngologist who prescribed her another course of oral antibiotics (cefuroxime 250 mg twice daily for 7 days).

After two courses of antibiotics, the painful neck lump had reduced in size, but the patient continued to experience pain, which was more severe on the right side of the throat. She also started experiencing a sharp pain at the angle of the right jaw, radiating to the right ear, as well as multiple mouth ulcers mostly found on the right side of the tongue. The patient became very anxious, returned to the otolaryngologist six weeks after the onset

of the symptoms, and requested for a rhinolaryngoscopy to exclude malignancy, which revealed no abnormal findings. The patient also had an ultrasound done on the right side of her neck, with no findings of significance.

As a definitive diagnosis could not be made, the patient went back to her dentist to exclude the possibility of a failed re-root canal treatment. An orthopantomograph of the teeth was taken and revealed a small area of radiolucency at the tips of the roots of tooth 32 (Figure 1). However, the findings did not correlate with the severity of the pain and were not suggestive of an infection. She continued to tolerate the pain despite the use of ete-rocoxib 90 mg daily for a week.

With episodes of fitful sleep and a history of silver allergy, it was suspected that the chronic pharyngitis could be related to the metal crown. The metal crown was eventually removed after eight weeks of persistent sore throat and recurrent mouth ulcers. Within 48 hours, the patient's symptoms improved tremendously, and she had an uneventful recovery.

Discussion

The case presented demonstrates how a simple case of chronic sore throat could be mistreated for bacterial pharyngitis. The patient was prescribed ete-rocoxib every day for a week and two courses of antibiotics. She also had a rhinolaryngoscopy, an ultrasound and an orthopantomograph done, which were all not very helpful in her condition. It was later discovered that the metal crown which was put on by the dentist after the re-root canal treatment contained nickel and chromium.

Commonly used metals in dental materials such as nickel, chromium, cobalt, gold, palladium and titanium have been shown to cause allergies.⁵ In one study that assessed dental metal allergies using patch tests, 44% of the 925 patients had a positive response to any metals used in the patch test. The metals with the highest positivity rates were nickel, palladium and zinc (22.5%, 14.8% and 11.5% respectively) whereas 42.2% of the patients

reported metal allergy-associated conditions. Among patients who underwent treatment involving removal of the metal, 55.6% reported symptom improvement after the treatment.⁶

Had the dentist taken a careful history, a metal crown could have been avoided and a non-metal one could have been used instead. In addition, the unilateral pain on the throat and the occurrence of unilateral ulcers on the tongue had given clues to the allergy. This case also demonstrates the importance of a thorough dental history in the medical practice. A correct diagnosis would have been derived much earlier had this been explored with greater details.

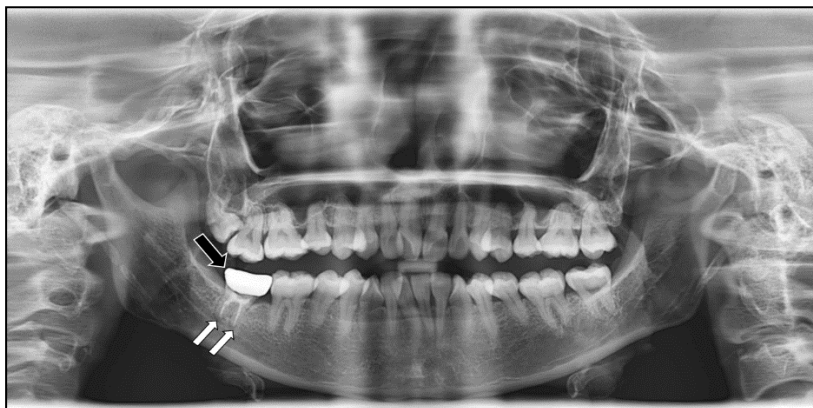


Figure 1 Dental orthopantomograph of the patient showing small areas of radiolucency at the tips of the root of tooth 32 (white arrows) and the metal crown (black arrow).

Conclusion

This case interestingly shows how the cause of common conditions like sore throat and mouth ulcers could be overlooked in the primary care setting. It also demonstrates the importance of taking a careful history to identify the underlying cause. The moral of the story is that, when all else fails, it is always worthwhile re-visiting a patient's history to find the missing piece of the puzzle. Sometimes, minor details that seem irrelevant at the

point of the first consultation turn out to be the main cause of the presenting condition.

Another important message that can be derived from this case is that medical practitioners should use antibiotics carefully. In this case, the patient might have suffered from bacterial pharyngitis. However, it may not be necessary to take two courses of oral antibiotics, as the main problem was an allergy to the metal crown. This is evident by the fact the condition resolved after the removal of the metal crown. It is also important for dentists to treat their patients with great care when using dental materials that contain metals in the mouth.

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Papers satisfying all the above requirements will be published without reverting to the main author. Papers requiring amendments, additional work, etc., will be sent back to the author/main author who is required to make the necessary corrections before sending it back to the editor within ten (10) working days.

Presentation

The title of the paper should be brief. An abstract, not exceeding two hundred (200) words, which is the summary of the scope and principal findings contained in the paper, must be included.

Papers done in a collaborative effort must include the names and addresses of all the authors in full, with the main author's name appearing first. All correspondences will be directed to the main author.

All graphs, figures, tables, charts, etc are to be submitted preferably as attachments.

Instructions on referencing

1. When reference is made to a paper in a journal, the volume number must be bold. (I.j.raslah, b.c.tan and h.w.lee, appl. Opt. 30 (4), 485 (1991))
2. For book references, the name of the book must be in italics.(h.r.griem, plasma spectroscopy, mcgraw hill, new york (1964))
3. When referring to a paper in a contribution volume, the volume must be in italics.(b.c.tan, 'science and technology in industrial development in malaysia' in physics and industry, ed. E.maruyama and h.watanabe, proceedings lupap, springer-verlag (1993) pp. 71- 92)

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